A/NO FEE

Docket No.: NHL-PLJ-06

"Express Mail" mailing label number EM417859063US
Date of Deposit June 5, 1997

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Re: U.S. Patent Application to be filed under 35 U.S.C. §111 claiming priority from Swedish Patent Application No. 9602257-9, filed June 7, 1996.

INVENTOR: Erland LUNDSTRÖM
TITLE: METHOD OF PRODUCING A SHEET STEEL PRODUCT SUCH AS A REINFORCEMENT ELEMENT IN A LARGER STRUCTURE

Greensburg, Pennsylvania 15601

Assistant Commissioner for Patents
Washington, D.C. 20231

June 5, 1997

BOX PATENT APPLICATION

TRANSMITTAL LETTER FOR NEW PATENT APPLICATION UNDER 35 U.S.C. §111

Sir:

Priority is claimed under 35 U.S.C. §119.

Please find enclosed herewith the following documents relating to the above-cited case:

(X) 1. the above-identified patent application having 6 pages and 8 claims;

(X) 2. an unsigned Supplemental Declaration and Power of Attorney document;

(X) 3. 2 sheets of drawings;

(X) 4. a Preliminary Amendment having 11 pages;

(X) 5. an Information Disclosure Citation (Form PTO-1449);

(X) 6. a copy of art (1) cited in the Information Disclosure Citation; and

(X) 7. a stamped, self-addressed postcard, return of which is requested to acknowledge receipt of the enclosed documents.

NHL:mah/ksm/dlb

PLJ-06 05/PLJ007

TRANSMITTAL LETTER
Page 2

A signed declaration and a fee are not presented at this time but will be supplied when a request is made.

** SEND CORRESPONDENCE TO **

NILS H. LJUNGMAN
NILS H. LJUNGMAN & ASSOCIATES
P.O. BOX 130
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Respectfully submitted,

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Date of Deposit June 5, 1997

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" Service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Daniel P. Fleming
(Typed or printed name of person mailing paper or fee)

Daniel P. Fleming
(Signature of person mailing paper or fee)

NHL:mah/ksm/dlb

This invention relates to a method of producing a sheet steel product by heating a sized steel sheet, hot forming the steel sheet in a pair of tools and hardening the formed product by cooling it rapidly from an austenitizing temperature while it is still in the pair of tools and then machining the product.

This method of making hardened sheet steel products is known from GB-149035-A incorporated herein by way of reference and it is called press hardening. A great advantage is that hardened products with complicated form can be produced and still, the tolerances in form and size can be narrow.

In order to reach very high position accuracy of some details, for example holes, slots and the like, a machining operation is carried out on the hardened product. This machining causes high tool wear and may cause reduced fatigue resistance.

It is an object of the invention to improve the method of producing complicated hardened products by press hardening and subsequent machining and to improve the qualities of the products. This is accomplished in principle in that mild areas are left in the product and the machining is carried out in these mild areas. The invention has been given the characteristics stated in the claims.

The invention will be described with reference to the accompanying drawings. Figure 1 shows an example of a product produced in accordance with the invention. Figure 2 shows schematically a part of the product shown in Figure 1 clamped in a pair of forming tools. Figures 3 and 4 show schematically the same part of the product as in Figure 2 clamped in modified forming tools.

The finished product 11 of thin sheet steel shown in Figure 1 has a complicated form and it has three holes 12, 13, 14 with high demands on accuracy in their positions. The holes can therefore not be made in the flat sheet before the forming but must be made after the forming. The sheet can for example be 1 - 3 mm thick and the product can for example be a safety bar for car doors.

In figure 2, a part of the product 11 is shown clamped in the corresponding parts of a pair of cooled tools (16, 17) of a press forming machine. The flat cut-to-size sheet is heated in a furnace to a temperature above Ac_3, that is, the austenite area. The heated sheet is moved in between the pair of tools and the tools clamp the sheet and forms it in a rapid forming operation. The forming should be so qvick that the steel does not harden during the forming operation. Then, the sheet remains in the cooled tools which serves as a fixture after the forming and during the cooling. The cooling should be so rapid that the steel will have a suitable martensitic structure as described in GB-1490535-A and the analysis of the steel should preferably be as described therein.

Around the areas in which the holes 12, 13, 14 are to be made, there are inserts 20, 21, suitably ceramic inserts, in the tools. These inserts have a lower heat conducting ability than the rest of the tools and they cause the sheet to cool more slowly in these areas than otherwise. Thus, the sheet hardens less, that is, is less martensitic, or does not harden at all in these areas.

Then, when the holes 12 - 14 are punched or made in another way, their edges will be more even than they would be if they were punched in a hardened material. There will also be less microcracks. This will have a positive effect on the fatigue strength. The wear of the machining tools will also be reduced which is an advantage economically.

Figure 3 shows tools 16, 17 which have recesses 23, 24 instead of the inserts 20, 21 in Figure 2 so that thin clearances are formed between the tools 16, 17 and the sheet 11 in the areas for subsequent machining, that is in the areas in which the holes 12 - 14 are to be punched. The recesses 23, 24 reduces the cooling effect of the tools and the result will be the same as when the inserts 20, 21 are used, that is, the steel will not transform into martensite at all or at a reduced degree.

Figure 4 shows an alternative design with induction elements 27, 28 in the tools 16, 17. By induction heating, the rapid cooling can be prevented and the steel can be prevented from hardening in the area of the induction elements.

It will also be possible to permit martensite to form and to temper the formed martensite by heating the steel by the use of the induction elements 27, 28. It is also possible to heat by other methods than induction heating.

As an alternative to the providing of mild steel areas in the steel directly in the forming tools as described with reference to the Figures 2 - 4, one can have the entire product 11 harden in the tools and then, in a separate process, temper the areas in which the machining is to be carried out. In such a case, the tempering can be carried out in direct connection with the machining operation by using a machine, for example a punch, that has a heating device, for example an induction heating element, built into it.

Claims

1 A method of making a sheet steel product by heating a sized steel sheet, hot forming the steel sheet in a pair of tools (16, 17) and hardening the formed product by cooling it rapidly from an austenitizing temperature while it is still in the pair of tools and then machining the product,
c h a r a c t e r i z e d in that mild areas are left in the product and the machining is carried out in such mild areas.

2 A method according to claim 1,
c h a r a c t e r i z e d by preventing said areas from hardening by preventing rapid cooling thereof.

3 A method according to claims.
c h a r a c t e r i z e d by keeping a clearance between the tools (16, 17) and said areas for preventing rapid cooling thereof.

4 A method according to claim 2.
c h a r a c t e r i z e d by keeping heat insulating inserts (20, 21) in the tools against said areas for preventing rapid cooling thereof.

5 A method according to claim 1,
c h a r a c t e r i z e d in that the entire product is hardened in the tools and said areas are then tempered.

6 A method according to claim 5,
c h a r a c t e r i z e d in that said areas are tempered while the product is still in the tools.

7 A method according to claim 5,
c h a r a c t e r i z e d in that said areas are tempered when the product has been removed from the tools.

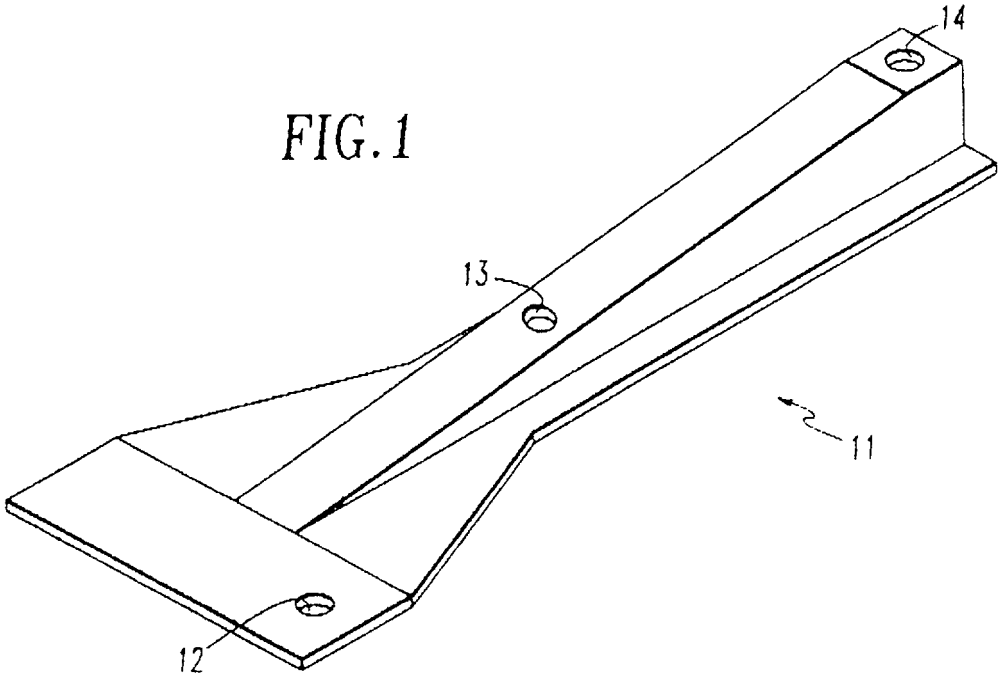
8 A method according to claim 7,

c h a r a c t e r i z e d in that said areas are tempered in connection with the machining operation.

Abstract

A product (11) of sheet steel is formed in a pair of cooled tools (16, 17) when hot and hardened to a martensitic structure when still in the tools so that the tools act as a fixture during the hardening. The steel is kept mild in the areas in which it is to be machined, for example punched. Inserts (20, 21) in the tools are used to prevent rapid cooling and thereby a martenitic structure in these areas. The same effect can be obtained by recesses (23, 24) in the tools so that there will be a gap between the sheet steel(11)and the tools.

FIG.1



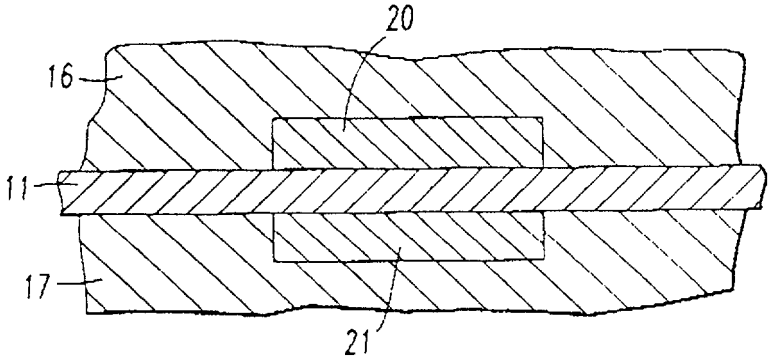
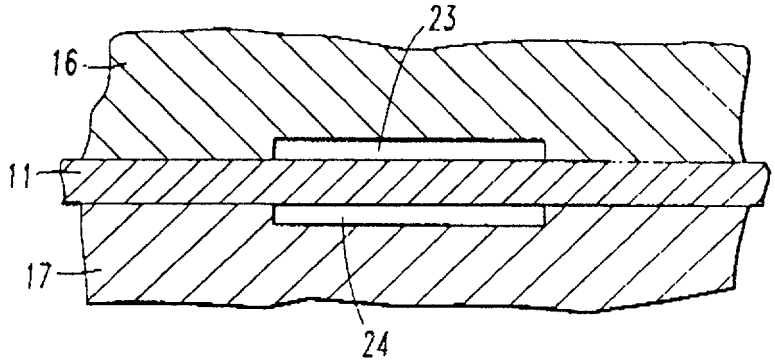


FIG.2

FIG.3



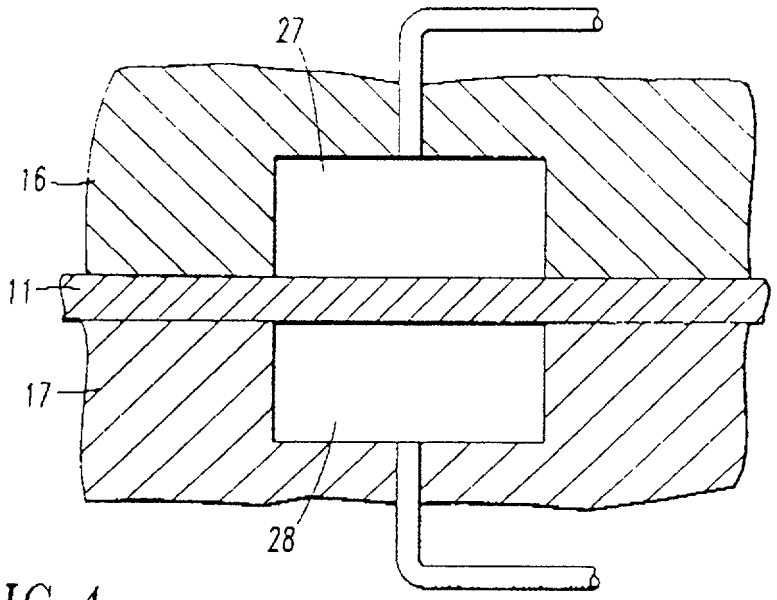


FIG.4

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

EXAMINER: (NOT YET RECEIVED)

ART UNIT: (NOT YET RECEIVED)

SERIAL NO.: (NOT YET RECEIVED)

FILING DATE: June 5, 1997

INVENTOR: Erland Lundström

TITLE: METHOD OF PRODUCING A SHEET STEEL PRODUCT SUCH AS A REINFORCEMENT ELEMENT IN A LARGER STRUCTURE

Greensburg, Pennsylvania 15601

Assistant Commissioner for Patents

Washington, D.C. 20231

June 5, 1997

BOX PATENT APPLICATION

PRELIMINARY AMENDMENT

Sir:

Please enter the following Preliminary Amendment in order to place the above-cited application in better condition for examination.

In the Specification:

Please amend the following, without prejudice:

Page 1, before line 1, insert the following title and text:

--METHOD OF PRODUCING A SHEET STEEL PRODUCT SUCH AS A REINFORCEMENT ELEMENT IN A LARGER STRUCTURE

BACKGROUND OF THE INVENTION

1. Field of the Invention:--.

Page 1, line 1, before "invention" delete 'This' and substitute therefor --The present--.

Page 1, between lines 4 and 5, insert --2. Background of the Invention:--.

Page 1, between lines 11 and 12, insert centered on the page --OBJECT OF THE INVENTION--.

Page 1, line 12, before "invention" insert --present--.

Page 1, lines 15 and 16, after "mild areas." delete 'The invention has been given the characteristics stated in the claims.'.

Page 1, between lines 16 and 17, insert the following text:

--SUMMARY OF THE INVENTION

The present invention teaches that this object can be achieved by leaving mild areas in the product and then by carrying out the machining in such mild areas.

In alternative embodiments of the present invention, the machining process referred to herein can also include any equivalent or related process. Examples of such processes which could be incorporated in embodiments of the present invention include, but are not limited to, embossing, inlaying, welding or weld depositing, cold working, punching, reaming and boring.

Another object can be carried out by preventing certain areas from hardening by preventing rapid cooling thereof.

In another embodiment of the present invention, a clearance can be kept between the tools and the areas for preventing rapid cooling thereof.

In yet another embodiment of the invention, the heat insulating inserts in the tools can be kept against the areas for preventing rapid cooling thereof.

In another embodiment of the present invention, the entire product can be hardened in the tools and the areas are then tempered.

In another embodiment of the present invention, the areas can be tempered while the product is still in the tools.

In another embodiment of the present invention, the areas can be tempered when the product has been removed from the tools.

In yet another embodiment of the present invention, the areas can be tempered in connection with the machining or boring or finishing or drilling operation.

The above discussed embodiments of the present invention will be described further hereinbelow with reference to the accompanying figures. When the word "invention" is used in this specification, the word "invention" includes "inventions", that is, the plural of "invention". By stating "invention", the Applicant does not in any way admit that the present application does not include more than one patentably and non-obviously distinct invention, and maintains that this application may include more than one patentably and non-obviously distinct invention. The Applicant hereby asserts that the disclosure of this application may include more than one invention, and, in the event that there is more than one invention, that these inventions may be patentable and non-obvious one with respect to the other.

BRIEF DESCRIPTION OF THE DRAWINGS--.

Page 1, between lines 21 and 22, insert centered on the page --DESCRIPTION OF THE PREFERRED EMBODIMENTS--.

Page 1, line 23, after "The holes" insert --12, 13, 14--.

Page 1, line 25, after "product" insert --11--.

Page 2, line 4, after "pair of tools" insert --16, 17--.

Page 2, line 4, after "and the tools" insert --16, 17--.

Page 2, line 5, after "be so" delete 'qvick' and substitute therefor --quick--.

Page 2, line 6, after "tools" insert --16, 17--.

Page 2, line 6, after "which" delete 'serves' and substitute therefor --tools serve--.

Page 2, line 7, after "fixture" insert --or support or form or brace--.

Page 2, line 9, after "analysis" insert --or makeup or composition--.

Page 2, line 11, after "suitably" insert --or preferably--.

Page 2, line 11, after "the tools" insert --16, 17--.

Page 2, line 11, after "These inserts" insert --20, 21--.

Page 2, line 12, after "tools" insert --16, 17--.

Page 2, line 13, after "otherwise." insert --In other words, the areas of the sheet adjacent the inserts cools more slowly than the remainder of the sheet.--.

Page 2, line 22, after "23, 24" delete reduces and substitute therefor --reduce--.

Page 2, line 22, after "tools" insert --16, 17--.

Page 2, line 24, after "at all or" insert --will do so--.

Page 3, line 1, after "and to" insert --then--.

Page 3, after line 9, please insert the following paragraphs:

--One feature of the invention resides broadly in a method of making a sheet steel product by heating a sized steel sheet, hot forming the steel sheet in a pair of tools and hardening the formed product by cooling it rapidly from an austenitizing temperature while it is still in the pair of tools and then machining the product, characterized in that mild areas are left in the product and the machining is carried out in such mild areas.

A further feature of the invention resides broadly in preventing said areas from hardening by preventing rapid cooling thereof.

Another feature of the invention resides broadly in keeping a clearance between the tools 16, 17 and said areas for preventing rapid cooling thereof.

Still another feature of the invention resides broadly in keeping heat insulating inserts 20, 21 in the tools against said areas for preventing rapid cooling thereof.

Another feature of the invention resides broadly in that the entire product is hardened in the tools and said areas are then tempered.

Yet another feature of the invention resides broadly in that said areas are tempered while the product is still in the tools.

Still another feature of the invention resides broadly in that said areas are tempered when the product has been removed from the tools.

Another feature of the present invention resides broadly in that said areas are tempered in connection with the machining or boring or finishing or drilling operation.

Examples of steel sheets, and methods for forming steel sheets which may be used in conjunction with embodiments of the present invention may be found in the following U.S. Patents: No. 5,382,302; No. 5,383,592; No. 5,392,843; No. 5,407,493; No. 5,421,969; No. 5,425,820; No. 5,431,753; No. 5,439,165; No. 5,462,615; No. 5,467,811; and No. 5,470,529.

Examples of induction heating devices which may be used in conjunction with embodiments of the present invention may be found in the following U.S. Patents: No. 5,378,879; No. 5,408,072; No. 5,409,553; No. 5,411,570; No. 5,455,402; No. 5,472,528; and No. 5,479,436.

Examples of methods and devices for machining metal which may be incorporated in embodiments of the present invention, may be found in the following U.S. Patents: No. 5,466,099; No. 5,385,040; No. 5,397,420; No. 5,398,572; No. 5,417,132; No. 5,439,431; No. 5,444,902; No. 5,447,485; and No. 5,474,406.

Methods of embossing or inlaying steel which may be incorporated in embodiments of the present invention may be found in the following U.S. Patents: No. 5,385,471; No. 5,391,517; No. 5,399,217; and No. 5,432,989.

Examples of metal punches and methods for using metal punches which may be incorporated in embodiments of the present invention may be found in the following U.S. Patents: No.

5,377,415; No. 5,377,519; No. 5,379,227; No. 5,388,330; No. 5,423,199; No. 5,432,989; No. 5,435,049; No. 5,465,473 and No. 5,475,999.

Examples of low heat conductivity ceramics which may be incorporated in embodiments of the present invention may be found in the following U.S. Patents: No. 5,378,144; No. 5,378,417; No. 5,380,482; No. 5,390,843; No. 5,408,070; No. 5,411,763; No. 5,420,395; No. 5,431,020; No. 5,451,448; No. 5,468,358; No. 5,471,721; No. 5,476,684; and No. 5,477,610.

Examples of car doors, and components therein, in which products made by the method of the present invention could be incorporated, may be found in the following U.S. Patents: No. 5,277,469; No. 5,256,219; and No. 5,093,990.

U.S. Patent No. 5,600,931, and U.S. Patent Applications: Serial Number 08/121597, filed on September 14, 1993, with inventor Ernst Kero; Serial Number 08/409806, filed on March 24, 1995, having the inventor Martin Jonnson; and Serial Number 08/686269, filed on July 25, 1996, having the inventor Martin Jonnson; and the references cited therein, are hereby incorporated by reference as if set forth in their entirety herein.

The components disclosed in the various publications, disclosed or incorporated by reference herein, may be used in the embodiments of the present invention, as well as, equivalents thereof.

The appended drawings in their entirety, including all dimensions, proportions and/or shapes in at least one embodiment of the invention, are accurate and to scale and are hereby included by reference into this specification.

All, or substantially all, of the components and methods of the various embodiments may be used with at least one embodiment or all of the embodiments, if more than one embodiment is described herein.

All of the patents, patent applications and publications recited herein, and in the Declaration attached hereto, are hereby incorporated by reference as if set forth in their entirety herein.

The corresponding foreign patent publication applications, namely, Swedish Patent Application No. 9,602,257-9, filed on June 7, 1996, having inventor Erland Lundström, as well as its published equivalents, and other equivalents or corresponding applications, if any, in corresponding cases in Sweden and elsewhere, and the references cited in any of the documents cited herein, are hereby incorporated by reference as if set forth in their entirety herein.

The details in the patents, patent applications and publications may be considered to be incorporable, at applicant's option, into the claims during prosecution as further limitations in the claims to patentably distinguish any amended claims from any applied prior art.

Although only a few exemplary embodiments of this invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the following claims. In the claims, means-plus-function clause are intended to cover the structures described herein as performing the recited function and not only structural equivalents but also equivalent structures.

The invention as described hereinabove in the context of the preferred embodiments is not to be taken as limited to all of the provided details thereof, since modifications and variations thereof may be made without departing from the spirit and scope of the invention.--

In the Abstract:

Please delete the abstract currently on file on page 6, without prejudice, and substitute the following:

--METHOD OF PRODUCING A SHEET STEEL PRODUCT SUCH AS A REINFORCEMENT ELEMENT IN A LARGER STRUCTURE

ABSTRACT OF THE DISCLOSURE

A product of sheet steel is formed in a pair of cooled tools when hot and is then hardened to a martensitic structure while still in the tools. In this manner, the tools function as a

fixture while the steel is hardening. The steel is kept mild in the areas in which it is to be machined, for example punched. Inserts in the tools are used to prevent rapid cooling of the steel sheet and thereby a martensitic structure in the areas adjacent the inserts. The same effect can be obtained by recesses in the tools so that there will be a gap between the sheet steel and the tools.--

In the Claims:

Please cancel Claim 3, without prejudice.

Please add the following newly presented claims.

--9. A method according to Claim 1 characterized by keeping a clearance between the tools and said areas for preventing rapid cooling thereof.--

--10. A method according to Claim 2 characterized by keeping a clearance between the tools and said areas for preventing rapid cooling thereof.--

REMARKS

This preliminary amendment is being submitted for the purpose of placing the application in better condition for examination.

It is submitted that Applicant has provided a new and unique Method of Producing a Sheet Steel Product such as a Reinforcement Element in a Larger Structure. It is submitted that the claims, as now presented, are fully distinguishable over the prior art. Therefore, it is requested that a Notice of Allowance be issued at an early date.

~~If mailed, I, the person signing this certification below,~~ hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231, on the date indicated in the certification of mailing on the transmittal letter sent herewith, or if facsimile transmitted, I, the person signing this certification below, hereby certify that this paper is being facsimile transmitted to the United States Patent and Trademark Office on the date indicated in the certification of facsimile transmission on the transmittal letter which is being facsimile ~~transmitted herewith~~.

6-5-97

Respectfully submitted,

Nils H. Ljungman, Esq.
Attorney for Applicant
Reg. No. 25,997
Name of person signing certification
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Supplemental Declaration Claiming Priority Solely Under 35 USC §119 — Deutsch
U.S. Patentanmeldung — U.S. Patent- und Warenzeichenamt

SOLE/JOINT INVENTOR DECLARATION
U.S. LETTERS PATENT

NHL File Number:
NHL-PLJ-06

EXAMINER: (NOT YET RECEIVED)
ART UNIT: (NOT YET RECEIVED)
SERIAL NO.: (NOT YET RECEIVED)
FILING DATE: June 5, 1997
INVENTOR: Erland LUNDSTRÖM
TITLE: METHOD OF PRODUCING A SHEET STEEL PRODUCT SUCH AS A REINFORCEMENT ELEMENT IN A LARGER STRUCTURE

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I verily believe I am the original, first and sole inventor (if only one name is listed below) or a joint inventor (if plural inventors are named below) of the invention entitled (ERFINDUNG UNTER DEM TITEL): METHOD OF PRODUCING A SHEET STEEL PRODUCT SUCH AS A REINFORCEMENT ELEMENT IN A LARGER STRUCTURE

which was filed on June 5, 1997, as Application Serial No. _____, and as amended in the Preliminary Amendment which is being filed contemporaneously herewith.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):	Priority is claimed from:	
Sweden	9602257-9	7 June 1996
(Country) (LAND)	(Number) (AKTENZEICHEN)	(Day/Month/Year Filed) (TAG/MONAT/JAHR ANMELDETAG)

POWER OF ATTORNEY: As a named inventor, I hereby appoint and authorize Nils H. Ljungman, Reg. No. 25,997, and Thomas N. Ljungman, Reg. No. 32,041, of P.O. Box 130, Greensburg, PA 15601-0130, (412) 836-2305, my attorney and agent with full power of substitution and revocation, to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

SEND CORRESPONDENCE TO:
NILS H. LJUNGMAN, ESQUIRE
NILS H. LJUNGMAN & ASSOCIATES
P.O. BOX 130
GREENSBURG, PA 15601-0130

I hereby declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

	1)	2)	3)
Name(s) of Inventor(s) (NAME(N) DES ERFINDERS ODER DER ERFINDER, VOR- UND ZUNAME)	Erland LUNDSTRÖM		
Signature(s) of Inventor(s) (EIGENHÄNDIGE UNTERSCHRIFT DES ERFINDERS)			
Date(s) of Signature(s) (DATUM)	___. ___ 199___ (TAG. MONAT)	___. ___ 199___ (TAG. MONAT)	___. ___ 199___ (TAG. MONAT)
Country of Citizenship (STAATSANGEHÖRIGKEIT)	Sweden		
Address - Post Office & Residence (ADRESSE)	Domarvägen 8		
City - Post Office & Residence (STADT)	S-954 32 Luleå		
State or Country - Post Office & Residence (STAAT ODER LAND)	Sweden		

NHL:mah/ksm/dlb

PLJ-06/WP6.0